International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 1042-1047

Received: 12-09-2020
Accepted: 14-10-2020

Puleshwar Kumar
Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Dr. Pravin Kumar Sharma
Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Anisha Tirky
Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Puleshwar Kumar
Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Effect of different levels of fertilizer and mulching materials on growth, yield and quality of potato (*Solanum tuberosum* L)

Puleshwar Kumar, Dr. Pravin Kumar Sharma and Anisha Tirky

DOI: https://doi.org/10.22271/chemi.2020.v8.i6o.10902

Abstract
The experiment was conducted at Horticultural Research Cum Instructional Farm, College of Agriculture, I.G.K.V. Raipur, Chhattisgarh during the 2019-2020 Rabi season to investigate the "Effect of different levels of fertilizer and mulching materials on growth, yield and quality of potato (*Solanum tuberosum* L)" The experiment was carried out under split plot design with four replications. There were two different fertility levels in the main plot. F_1 (75% NPK) and F_2 (100% NPK). Whereas sub plot had five different mulch treatment M_0 (no mulch), M_1 (paddy straw mulch), M_2 (black polyethylene mulch), M_3 (woven mulch) and M_4 (silver mulch). The goal of this study is to define the possible outcome of different types of mulches influencing parameters on plant growth and yield. The application of 100% N,P,K was most suitable for providing better performance to plant emergence, emergence percent, number of shoots and number tubers and grade wise tubers yield. Among the different mulches were evaluated woven mulch was recorded for maximum yield of tuber (25.9 t/ha) followed by black polyethylene mulch (24.9 t/ha). While, lowest no mulch (20.9 t/ha). Quality parameters such as specific gravity, haulm dry matter content, tuber dry matter content, dry weight of tuber and total yield of tuber were found to be higher in woven mulch. While, lowest in no mulch. The interaction effect of this two combinations recorded significant maximum tuber yield (28.10 t/ha) and maximum net income (3837034.35) were observed that the application of 100% NPK with woven mulch. The present study also found that potato crop should be planted on 100% N,P,K with woven mulch or 100 % N,P,K with black polyethylene mulch for higher tuber production.

Keywords: Potato, polyethylene mulch, fertility levels, tuber yield

Introduction
The production of vegetables plays a pivotal role in Indian agriculture, it provides food and nutrition to consumer as well as economical support to farmers. It also generates foreign trades and satisfies processing industries by supplying raw material. The total area under vegetable cultivation in the world is 10.25 million hectares with a production of 184.39 million tonnes and a productivity of 18.00 tonnes per hectare (Anonymous, 2018) [2].

Potato (*Solanum tuberosum* L.) is a major cash crop for both the temperate and subtropical climate. It is popularly known as “Alloo”, and member of Solanaceae family, having chromosome number 2n=4x=48 originated in South America. India ranks second in production and third in area after China and Russia. It has fourth position among the most important food crops, after wheat, rice and maize (Anonymous, 2010). Potato is considered to be the king of vegetables, it is an underground tuber crop and considered as a new world food crop, produced and consumed globally. It is also an important food crop, particularly for populated countries like India and has ability to satisfy increasing food demands and food security of the of country.

Total global area under potato cultivation was 17.58 million hectares from which total 368.24 million tonnes of potato produced during 16.64 tonnes per hectare of productivity (Anon, 2018) [2]. In India 21.42 lakh hectares area under potato cultivation with 513.27 lakh MT production with average productivity of 23.68 tonnes per hectare (Anon, 2019) [1]. In Chhattisgarh is mainly known for rabi potato cultivation except Mainpat and Samripat where kharif crop have cultivated. In Chhattisgarh total 45435 hectares area under potato crop with 682342 tonnes production and 15.02 tonnes productivity per hectare (Anon, 2019) [1].

Potato produces highest dry matter and edible protein per unit area under per unit time. It is rich source of starch of carbohydrates (22.6g), edible protein (2.8g), starch (16.3g), total sugar (0.6g), crude fibre (0.5g), fat (0.14g), mineral (0.9g), calcium (7.7mg), iron (0.75mg), and vitamin C 19.7mg on 100 g fresh weight of tuber.

The potato plant grown well under ample availability of all macro (N, P, K, Ca, Mg, S) and micro elements (Fe, Mn, B, Zn, Cu, Mo). Nitrogen is most important element as it is a constituent of proteins and influences the development of numerous physiological and biochemical processes, plant growth and consequently affects yield and quality. Phosphorus enhances tuber growth, increases tuber quality and increases tuber size. Potassium plays an important part in the plant's biological cycles, enhances the efficiency of the cooking and packaging, improves tubers' sensitivity to damage and influences dry matter concentration.

Mulching materials along with proper fertility levels increased the plant growth parameters *i.e.* plant emergence, total chlorophyll content, plant height, number of shoots and the yield of potato due to more availability of nutrients to the plant. The growth parameters were significantly higher in the mulched plants over the un mulched plants. Mulching practice affects crop growth and development in various ways, Sharma *et al.*, (2013) [14].

Material and Methods

The present investigation entitled, "Effect of different levels of fertilizer and mulching materials on growth, yield and quality of potato (*Solanum tuberosum* L)." was carried out during the year 2019-20 in *rabi* season located at Horticultural Research Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G). The experiment with Split Plot Design has been replicated four times with ten treatments. The field was divided into 40 experimental units of 3.0 m x 3.0 with 60 cm irrigation channel in between two units. The allotment of treatments to various plots done by random method. Treatment consist of various fertility levels F_1-75% NPK and F_2 - 100% NPK, and treatment consist various different mulching materials (M_0 - no mulch, M_1 Paddy straw mulch, M_2 - black polyethylene mulch, M_3 - Woven mulch and M_4 -silver polyethylene mulch). The treatments consist of ten treatment *viz.*, F_1M_0 – no mulch, F_1M_1 – paddy straw mulch, F_1M_2 – black polythene mulch, F_1M_3 -Woven mulch, F_1M_4 - silver mulch, F_2M_0– no mulch, F_2M_1 – paddy straw mulch, F_2M_2 – black polythene mulch, F_2M_3 -Woven mulch and F_2M_4 - silver mulch.

Result and Discussion

Emergence percent

The percent of emergence reported at 40 days after planting were analysed statistically which is presented in table 4.1 and depicted through figure 4.2. the percent emergence of plant at 40 days remained significantly affected with fertility levels and non significantly by mulching materials, the highest emergence percent was noted in 75% fertility level (91%) while lower under 100% fertility level (88%). As regards the mulching, data on the days for plant emergence percent ranged from (88.0 to 92.25%). Woven mulch showed highest emergence percent (92.25%). While, lowest day for plant emergence percent was recorded under no mulch (88.00%). In this investigation percent emergence was affected non-significantly by the interaction of these two factors. Among different treatment combination highest percent of plant emergence was noted in 75 % N,P,K with woven mulch (93.50%). While, the lowest percent emergence was noted in 100% N,P,K and no mulch (86.50%). Similar findings were also recorded, (Ping *et al*., 1994; Mahmood *et al.*, 2002 and Jagmohan *et al.*, 2013) [10, 14].

Plant height

The Plant height under different treatments was recorded at 40, 60 and 90 DAP presented in Table 4.1 and graphically figure 4.3 revealed that there was significantly difference due to application of different fertility levels and mulching materials. At 40 days after planting the tallest plant height was noted in 100% fertility level (33.30 cm) and lowest under 75% fertility level (31.61 cm). Among the mulch treatments tallest plant height was noted in black polyethylene mulch (34.55cm) found significantly superior over all treatment, followed by woven mulch (32.65cm), paddy straw (32.58cm) and silver polyethylene mulch (31.85cm) and lowest plant height was noted in no mulch (30.65cm). It was observed that between interaction effect of different fertility levels and mulching materials were differ significantly for plant height. tallest plant recorded in 100% N,P,K with black polythene mulch (36.20 cm) followed by 100% N,P,K with woven mulch (34.25 cm), 100% N,P,K with silver mulch F_2M_4 (33.05 cm) and 100% N,P,K and paddy straw mulch (32.45 cm). While lowest plant height was recorded in 100% N,P,K with no mulch (30.55 cm)**.** At 60 days after planting both the treatment and there combination were differ significantly tallest plant was noted in 100% fertility level (36.43 cm) followed by 75% fertility level (34.14 cm). Among the mulch treatment tallest plant height was recorded in black polythene mulch (37.5cm) which was significantly at par with woven mulch (35.68 cm), followed by paddy straw (35.32 cm) and silver polyethylene mulch (34.53 cm). The lowest plant height was noted in no mulch (33.41 cm). Among the treatment combinations, tallest plant height was recorded in 100% N,P,K with black polythene mulch (39.31 cm) followed by 100% N,P,K and woven mulch (37.40 cm), 100% N,P,K with silver mulch (36.10 cm) and 100% N,P,K with paddy straw mulch (35.60 cm). While, lowest plant height was recorded in 75% N,P,K and no mulch (33.40 cm). At 90 days after planting both the treatment and their combination were differ signified tallest plant height was found in 100% fertility level (37.87 cm) followed by 75% fertility level (35.42 cm). Among the mulch treatment tallest plant height was recorded in black polythene mulch (38.2 cm) and found significantly superior over all treatment followed by woven mulch (37.12 cm), paddy straw (36.81cm) and silver polyethylene mulch (36.25 cm). The lowest plant height was recorded in no mulch (34.74 cm). It was observed that between interaction application tallest plant height was recorded in 100% N,P,K with black polythene mulch (39.84 cm) followed by 100% N,P,K with woven mulch (39.25 cm), 100% N,P,K with silver mulch (37.60 cm) and 100% N,P,K with paddy straw mulch (37.41 cm) while, lowest plant height was recorded in 75% N,P,K with no mulch (34.60 cm)**.** Similar results have also been reported by (Singh and Ahmed 2008 and Jagmohan 2013, Singh *et al.*, 2019) [11, 14].

Number of shoot per plant

Numbers of shoots per plant were recorded at 40, 60 and 90 DAP and presented in Table 4.1 and depicted through figure 4.4. It was observed that numbers of shoots per plant were different significantly, due to application of different fertility levels and mulching materials and their combination at all the intervals evaluates. At 40 days after planting the maximum

number of shoots per plant was noted in 100% fertility level (4.17) and minimum in 75% fertility level (3.60), Among the mulch treatments number of shoots per plant was under woven mulch (4.13) followed by black polythene mulch (4.01) While minimum number of shoots per plant was under no mulch (3.68). Among the different treatment combinations, maximum number of shoots per plant was noted in 100% N,P,K with woven much (4.35). Whereas, minimum found in 75% N,P,K with no much (3.35). At 60 days after planting the highest number of shoots per plant was found in 100% fertility level (4.54) followed by 75% fertility level (4.02). Among the mulch treatments, woven mulch 4.60 showed the maximum number of shoots per plant followed by black polythene mulch 4.30 However, lower under no mulch 4.01. The interaction of these two factors was showed differ non-significantly. Among all the different treatment combination observed maximum number of shoot per plant was noted in 100% N,P,K with woven much (4.25). Whereas minimum found in 75% N,P,K with black polythene much (3.45). At 90 days after planting the maximum number of shoots per plant was recorded in 100% fertility level (4.86) than 75% fertility level (4.29). Among mulches. Maximum number of shoots per plant were recorded in woven mulch 5.01. While, the minimum number of shoots per plant were recorded in no mulch (4.25). The interaction of these two factors was showed differ non-significantly. Among all the different treatment combination observed maximum number of shoot per plant was noted in 100% N,P,K with woven much (4.45). Whereas minimum found in 100% N,P,K with no much (3.85). Similar results have also been reported by (Samy *et al.*, 2013 and Pulok *et al.*, 2016) [18]

Grade wise tuber yield per hectare

Grade-wise tuber yield per plots t/ha (25-50g, 50-75g and >75g) were recorded under different treatments and there interaction effects are presented in table 4.5 and figure 4.22 to 24.The 25-50g tubers, maximum grade-wise of tuber yield t/ha 25-50g was recorded in 75% fertility level (5.29 t/ha) as compared to 100% fertility level (5.09 t/ha). Among the mulch materials. Highest tuber yield 25-50g t/ha was recorded under silver mulch (5.60 t/ha). While, lowest tuber yield t/ha was recorded under no mulch (4.60 t/ha). The combinations of these two treatments were differ non-significantly. Among different treatment combination highest tuber yield t/ha (25-50 g) was noted in 100% N,P,K with silver mulch (5.76 t/ha). While, the lowest tuber yield t/ha (25-50 g) was noted in 75% N,P,K with no mulch (4.43 t/ha). The 50-75g tubers, maximum tuber yield t/ha 50-75g was recorded under 100% fertility level (6.44 t/ha) as compared to 75% fertility level (4.32). As regards the mulching materials. The highest tuber yield t/ha (50-75 g) was recorded under silver mulch (6.02 t/ha) and the lowest tuber yield t/ha (50-75 g) was recorded under no mulch (4.73 t/ha). The combinations of these two treatments were differ non-significantly. Among different treatment combination highest tuber yield t/ha (50-75 g) was noted in 100% N,P,K with silver mulch (7.25 t/ha). While, the lowest tuber yield t/ha (50-75 g) was noted under 75% N,P,K with black polythene mulch (3.30 t/ha). The (>75 g) tuber, maximum tuber yield t/ha (>75 g) was recorded in 100% fertility level (6.50 t/ha) as compared to 75% fertility level (5.16 t/ha). As regards the mulching. The highest tuber yield t/ha (>75 g) were recorded under woven mulch (7.25 t/ha) which was significantly at par with black polythene mulch (6.09 t/ha), followed by paddy mulch (5.59 t/ha) and silver mulch (5.22 t/ha).While, the lowest tuber yield t/ha (>75 g) was recorded under no mulch (5.00 t/ha). The combinations of these two treatments were differ non-significantly. Among different treatment combination highest tuber yield t/ha (>75 g) was noted in 100% N,P,K with woven mulch (8.71 t/ha). While, the lowest tuber yield t/ha (>75g) was recorded under 75% N,P,K and no mulch (4.51 t/ha). Similar findings were also recorded (jail *et al.*, 2004 and Singh *et al.*, 2019) [7].

Marketable tuber (t/ha)

Marketable tuber yield t/ha was different treatment and there interaction effects are presented in table 4.5 and illustrated in figure 4.25. It is revealed from the data that there were significance difference for marketable tuber yield per plot t/ha under different fertility levels and mulching materials. Maximum tubers yield per plot recorded 100% fertility level (18.03 t/ha) as compared to 75% fertility level (14.77 t/ha). As regards the mulching. The maximum marketable tubers yield was recorded under woven mulch (18.4 t/ha) followed by silver mulch (16.84 t/ha), paddy mulch (16.40 t/ha) and black polythene mulch (16.02 t/ha). While, the minimum was recorded under no mulch (14.33 t/ha). The combinations of these two treatments were differ non-significantly. Among different treatment combination maximum marketable tubers yield was noted in 100% N,P,K with woven mulch (21.33 t/ha). Minimum marketable tubers yield was noted in 75% N,P,K with no mulch (13.23 t/ha). Indistinguishable results were also seen by (jail *et al.*, 2004 and Singh *et al.*, 2019) [7].

Unmarketable tuber

Unmarketable tuber yield t/ha was recorded under different treatment and their interaction effects are presented in table 4.5 and illustrated in figure 4.26. 75% fertility level was recorded highest unmarketable tuber yield (7.46 t/ha) as compared to 100% fertility level (6.83 t/ha). Various levels of mulching differ non-significantly for unmarketable tuber yield. Highest unmarketable tuber yield was recorded under black polythene (8.27 t/ha) followed by woven mulch (7.59 t/ha) and silver mulch (6.64 t/ha). While, lowest unmarketable tuber yield was recorded under paddy mulch (6.59 t/ha). The combinations of these two treatments were differ non-significantly. Among different treatment combination maximum unmarketable tuber was recorded under 75% N,P,K with black polythene mulch (9.01 t/ha). While, the lowest unmarketable tuber was noted in 100% N,P,K with silver mulch (6.09 t/ha).

Tuber yield (t/ha)

Tuber yield per plot t/ha for different treatment and there interaction effects are presented in table 4.5 and depicted through in 4.27. It is revealed from the data that there were significance difference for tuber yield per plot t/ha under different fertility levels and mulching materials and their interactions. highest tuber yield per plot t/ha was recorded under 100% fertility level (24.86 t/ha) and lowest was recorded under 75% fertility level (22.23 t/ha). Among the mulching treatments. Maximum total tuber yield of per plot t/ha was recorded under woven mulch (25.99 t/ha) followed by black polythene mulch (24.29 t/ha), silver mulch (23.48 t/ha) and paddy mulch (22.98 t/ha). While, the lowest tubers yield per plot t/ha was recorded under no mulch (20.98 t/ha). The interaction of these two treatments were differ non-significant differences, among different treatment combination maximum tuber yield per plot t/ha was noted in 100% N,P,K with woven mulch (28.10 t/ha). While, the minimum tuber yield per plot t/ha noted in 75% N,P,K and no

mulch (19.52 t/ha). Indistinguishable results were also seen by (Jail *et al.*,2004 and Jasmina *et al.*, 2018 and Singh *et al.*, 2019 and Bhagat *et al.*, 2016) [7].

Dry matter content of tubers (%)

Dry matter content of tuber per 100 g for fresh weight of tuber was recorded under different treatment and their interaction effects are presented in table 4.6 and illustrated in figure 4.28. Maximum dry matter content of tuber was recorded under100% fertility level (19.57 %) and lowest dry matter content of tuber was recorded under 75% fertility level (18.74 %). As regards the mulching materials. Highest dry matter content of tuber was recorded under black polythene (19.47 %), it is at par with woven mulch (19.32%), paddy straw mulch (19.20 %) and silver mulch (19.12 %) and the lowest dry matter content of tuber was showed under no mulch (18.74%). The interaction of these two factors were differ non-significantly, among different treatment combination highest dry matter content of tuber was noted in 100% N,P,K with black polythene mulch (19.84 %). While, the lowest dry matter content of tuber was noted in 75% N,P,K with no mulch (18.31 %). Similar finding results was recorded in (Zeng *et al.*, 2012, Jagmohan *et al.*, 2013 and Nizam *et al.*, 2017) [16, 14] they found that mulching was increased dry matter content as compared as no mulch.

Harvesting Index (HI)

Harvesting index was recorded under different treatment and their combinations are presented in table 4.7 and depicted figure 4.30. Maximum harvesting index was recorded in 100% fertility level (0.71) as compared to 75% fertility level (0.70). As regards to varying level of mulching materials. Highest harvesting index was noted in woven mulch (0.73) followed by black polythene mulch (0.72), and paddy straw mulch (0.70). While, the lowest harvesting index was recorded under no mulch (0.69). The combinations of these two treatments were differ non-significantly. Among different treatment combination highest harvesting index was noted in 100% N,P,K with woven mulch (0.74). While, the lowest harvesting index was noted in 75% N,P,K with no mulch (0.68).

Table 1: Effects of fertility levels and mulching materials on days for plant emergence, emergence percentage %, plant height, number of shoots and number of compound leaves, dry matter content of tuber and harvesting index at 40, 60 and 90 DAP

Treatments		Emergence percentage (%)	Plant height(cm)			Number of shoots/Plant			Dry Matter Content of tuber (%)	Harvesting Index
			40 DAP	60DAP	90DAP*	40 DAP	60DAP	90DAP*		
Fertility levels										
F1	75%NPK	91.25	31.61	34.14	35.42	3.60	4.02	4.29	18.47	1.02
F2	150%NPK	88.00	33.30	36.43	37.87	4.17	4.54	4.86	19.57	1.04
CD(P=0.05)		0.82	0.82	2.15	1.1	NS	NS	NS	0.72	0.004
Mulching										
M_0	No mulch	88.00	30.65	34.41	34.74	3.68	4.01	4.25	18.68	1.02
M_1	Paddy straw	89.63	32.58	35.32	36.81	3.86	4.18	4.87	19.20	1.03
M_2	Black polythene	90.25	34.55	37.59	38.24	4.01	4.30	4.90	19.47	1.04
M_3	Woven mulch	92.25	32.65	35.68	37.12	4.13	4.60	5.01	19.32	1.05
M_4	Silver mulch	88.00	31.85	34.53	36.25	3.73	4.10	4.32	19.12	1.03
CD(P=0.05)		NS	1.16	1.1	1.1	NS	NS	NS	NS	0.007
Fertility levels × mulching										
F_1M_0	No mulch	89.50	30.75	33.40	34.60	3.35	4.40	4.55	18.31	1.01
F_1M_1	Paddy straw	92.75	32.70	35.01	36.21	3.60	3.60	3.75	18.74	1.02
F_1M_2	Black polythene	91.00	32.90	35.70	36.60	3.88	4.15	4.39	19.10	1.03
F_1M_3	Woven mulch	93.50	31.05	33.87	35.08	3.90	3.45	4.05	18.83	1.05
F_1M_4	Silver mulch	89.50	30.65	33.09	34.85	3.25	4.50	4.85	18.74	1.03
F_2M_0	No mulch	86.50	30.55	33.50	34.91	4.00	3.55	3.85	19.05	1.04
F_2M_1	Paddy straw	86.50	32.45	35.60	37.41	4.13	3.71	4.03	19.66	1.04
F_2M_2	Black polythene	89.50	36.20	39.31	39.84	4.15	3.61	4.01	19.84	1.05
F_2M_3	Woven mulch	91.00	34.25	37.40	39.25	4.35	4.25	4.45	19.80	1.06
F_2M_4	Silver mulch	85.50	33.05	36.10	37.60	4.20	3.45	3.85	19.50	1.04
CD(P=0.05)		NS	2.26	2.05	1.82	NS	NS	NS	NS	NS

Table 2: Effect of fertility levels and mulching materials on yield of tuber (25-50), yield of tuber (>75g), yield of marketable tuber, yield of unmarketable tuber and yield of total tuber

Treatments		yield of tuber (25-50) t/ha	yield of tuber (50-75) t/ha	yield of tuber (>75) t/ha	marketable yield of tuber	Unmarketable yield of tuber	Total yield of tuber t/ha
Fertility level							
F_1	75% RDF	5.29	4.32	5.16	14.77	7.46	22.23
F_2	150% RDF	5.09	6.44	6.50	18.03	6.83	24.86
CD(P=0.05)		NS	0.90	0.88	1.48	1.85	0.50
Mulching							
M_0	No Mulch	4.60	4.73	5.00	14.33	6.64	20.98
M_1	Paddy Straw	5.12	5.69	5.59	16.40	6.59	22.98
M_2	Black Polythene	5.15	4.78	6.09	16.20	8.27	24.29
M_3	Woven Mulch	5.47	5.68	7.25	18.40	7.59	25.99
M_4	Silver Mulch	5.60	6.02	5.22	16.84	6.64	23.47
CD(P=0.05)		NS	NS	1.38	2.30	2.63	0.96
Fertility level × Mulching							
F_1M_0	No Mulch	4.43	4.29	4.51	13.23	6.29	19.52

F_1M_1	Paddy Straw	5.67	5.01	5.42	16.10	6.41	22.51
F_1M_2	Black Polythene	5.42	3.30	5.25	13.97	9.01	22.98
F_1M_3	Woven Mulch	5.48	4.19	5.80	15.47	8.41	23.88
F_1M_4	Silver Mulch	5.44	4.79	4.85	15.08	7.18	22.25
F_2M_0	No Mulch	4.78	5.18	5.49	15.45	6.99	22.45
F_2M_1	Paddy Straw	4.56	6.37	4.76	16.69	6.77	23.46
F_2M_2	Black Polythene	4.89	6.25	6.94	17.63	7.53	25.60
F_2M_3	Woven Mulch	5.45	7.17	8.71	20.79	6.77	28.10
F_2M_4	Silver Mulch	5.76	7.25	5.60	18.61	6.09	24.69
CD(P=0.05)		NS	NS	NS	NS	NS	NS

Conclusion

- 100 % RDF application is appropriable as compare to the reduced application of RDF up to 75% the higher levels of fertilizer can enhance the growth character and yield parameters of potato.
- The present investigation revealed that mulching in potato had significant response on growth, yield, quality and profitability. Among the different mulches were tested woven mulch showed overall excellent performance with respect to growth, yield and quality of potato with compared to other mulches.
- 100% N.P.K. with woven mulch was most suitable the fertilizer dose and mulch application solely as well as jointly influence potato yield and quality
- 100% N.P.K. with woven mulch accrued maximum benefit cost ratio, gross returns, net returns and net returns per rupee invested.

Acknowledgement

The authors are heartily thankful to Department of Vegetable Science, College of Agriculture, Raipur (Chhattisgarh) for providing field trial facilities in farm and for financial help. Also thankful to the Dean, College of Agriculture, Raipur for providing the facilities for the study and investigation.

References

1. Anonymous. All India Coordinated Research Project on Potato. Annual Report. Central Potato Research Institute. Shimla- 171001 2019.
2. Anonymous. Agriculture & resource economics, Food & Agricultural Organization of the united Nation 2010.
3. Anonymous. Area and Production of Horticulture Crops - All India, National Horticulture Board. Ministry of Agriculture. Government of India, Gurgaon, Haryana 2018.
4. Anonymous. Directorate of Horticulture and Farm Forestry, Horticulture Statistics, Department of Agriculture, Government of Chhattisgarh 2019.
5. Baljinder Singh, Balwinder Singh Dhillon, Gurjinder Singh. Influence of mulching on growth and yield of potato (*Solanum tuberosum L.)* in South West Punjab International Journal of Engineering, Applied and Management Sciences Paradigms 2019.
6. Bhagat Poonam, Gosal S.K. and Singh C.B. Effect of mulching on soil environment, microbial flora and growth of potato under field conditions, Indian J. Agric. Res.,50 (6) 542-548 2016.
7. Hong Zhao, Run-YuanWang, Bao-LuoMa, You-CaiXiong, Sheng-CaiQiang, ChunLingWang, *et al*. Ridge-furrow with full plastic film mulching improves water use efficiency and tuber yields of potato in a semiarid rainfed ecosystem, Field Crops Research 2014;161:137-148.
8. Huessein Abouziena, Hafez OM, Sharma SD. Comparison of weed suppression and mandarin fruit yield and quality obtained with organic mulches, synthetic mulches, cultivation, and glyphosate. Hortscience 2008;43(3):795-799.
9. Jalil MA, Azad MAK, Farooque AM. Effect of different mulches on the growth and yield of two potato varieties. Journal of Biological Sciences 2004;4(3):331-333.
10. Jimenez LI, Saldivar RH, Aguilar LA, Delrio LA. Colored plastic mulches affect soil temperature and tuber production of potato. Acta Agriculturae Scandinavica Section B Soil and Plant Science 2011;61:365-371.
11. Awal MA, Khan MAH. Mulch induced Eco-physiological growth and yield of Maize. Pakistan Journal of Biological Science 2000;3(1):61-64.
12. Mahmood MM, Farooq K, Hussain A, Sher R. Effect of mulching on growth and yield of potato crop. Asian Journal of Plant Sciences 2002;1(2):132-133.
13. Md. Ashraful Islam Pulok , Tuhin Suvra Roy , Md. Shahidur Rashid Bhuiyan , Md. Nazmul Haque and Nur-unnahar (2016). Effect of potassium and mulches on growth yield and economics of potato, Potato J 43 (2): 200-210.
14. Narendra Singh, Zakwan Ahmed. Effect of mulching on potato production in high altitude cold arid zone of Ladakh, Potato J 2008;35(3-4):118-121.
15. Nizam Uddin Ahmed1 , Nashir Uddin Mahmud Afzal Hossain, Asad Uz Zaman, Shyam Chandra Halder Performance of mulching on the yield and quality of potato International Journal of Natural and Social Sciences, 2017, 4(2): 07-13
16. Nizamuddin M, Mahmood M, Farooq K, Riaz S. Response of potato crop to various levels NPK. Asian Journal of Plant Sciences 2003;2(2):149-151.
17. Oljaca jasmina, BocIc zoran,and Momirovic Nebojsa. effects of cultivar and mulching on the potato yield, agro for international journal,3, issue no.1 2018.
18. Ping HC, Xuenjun CJ and Xing CJ.1994.The physiological and ecological effects of covering plastic film on potato. Acta Agriculture Zhejiangensis 6: 102-106.
19. Sarkar B, Mandal SS, Nayek SS, Saha M, Biswas S. Integrated nutrient management for the productivity and quality improvement of potato under irrigated condition. Potato Journal 2007;34(1-2):99-100.
20. Sharma GD, Singh Jagmohan. Effect of plastic mulching, planting methods and Fertility levels on growth and productivity of potato (*Solanum tuberosum* L.) Haryana J Agron 2013;31(1&2):35-40.

21. Tomokazu Haraguchi, Atsushi Marui, Kozue Yuge, Yoshisuke Nakano, Ken Mori. Effect of plastic-film mulching on leading of nitrate nitrogen in an upland field. paddy and water environment 2004, 67-72.
22. Zhao H, Xiong YC, Li FM, Wang RY, Qiang SC, Yao TF, *et al*. Plastic film mulch for half growing-season maximized WUE and yield of potato via moisture temperature improvement in a semi-arid agro-ecosystem. Agril. Water Manage 2012;104:68-69.
23. Zhong-Kuixie, Ya-junWang, Feng-Minli. Effect of plastic mulching on soil water use and spring wheat yield in arid region of northwest China, Agricultural Water Management Volume 2005;75:71-83.
24. Zohiri El, Samy MM. Influence of colored plastic mulches on germination, growth and marketable yield of potato, J Product. & Dev 2013;18(3):405-420.